REPORT RESUMES

ED 020 667 EM 006 148

THE PEACE CORPS EDUCATIONAL TELEVISION (ETV) PROJECT IN COLOMBIA--TWO YEARS OF RESEARCH. RESEARCH REPORT NO. 6, INSTRUCTIONAL TELEVISION FOR THE IN-SERVICE TRAINING OF THE COLOMBIAN TEACHER.

BY- COMSTOCK, GEORGE MACCOBY, NATHAN
STANFORD UNIV., CALIF.INST. FOR COMMUN. RES.

PUB DATE NOV 66

EDRS PRICE MF-$0.50 HC-$2.56 62P.

DESCRIPTORS- FEEDBACK, TEACHER MOTIVATION, *TEACHER ATTITUDES, INSTRUCTIONAL TELEVISION, GROUP INSTRUCTION, TELEVISION CURRICULUM, *DISCUSSION (TEACHING TECHNIQUE), TEACHER PARTICIPATION, *TELEVISED INSTRUCTION, *INSERVICE TEACHER EDUCATION, MATHEMATICS TEACHERS, TELEVISION VIEWING, TEACHING PROCEDURES, DEVELOPING NATIONS, MODERN MATHEMATICS,EDUCATIONAL TELEVISION, COLOMBIA, PEACE CORPS,

IN ORDER TO EVALUATE THE EFFECTIVENESS OF A 17-PROGRAM TELEVISED COURSE IN MODERN MATHEMATICS FOR PRIMARY SCHOOL TEACHERS PARTICIPATING IN THE PEACE CORPS ETV PROJECT, A MATH TEST AND A QUESTIONNAIRE WERE ADMINISTERED TO 1341 TEACHERS, DIVIDED BETWEEN COURSE VIEWERS AND NON-VIEWERS. MORE THAN HALF OF THE TEACHERS HAD VIEWED MORE THAN HALF OF THE PROGRAMS. TEST PERFORMANCE AND VIEWING OF THE COURSE WERE FOUND TO BE CLEARLY AND POSITIVELY RELATED. SUPERVISION OF VIEWING SESSIONS BY PEACE CORPS VOLUNTEERS WAS POSITIVELY RELATED TO AMOUNT OF VIEWING, AND THUS CONSTITUTED ONE MEANS OF INCREASING THE AUDIENCE. REGULAR AND FREQUENT DISCUSSIONS WITH OTHER TEACHERS AFTER EACH PROGRAM RESULTED IN SIGNIFICANTLY HIGHER TEST SCORES COMPARED TO NO SUCH DISCUSSIONS. THE MOST WANTED INSTRUCTIONAL AIDS TO ACCOMPANY TELEVISED INSTRUCTION WERE OPPORTUNITIES TO ASK QUESTIONS OF AN EXPERT OR TO PARTICIPATE IN A CONFERENCE LED BY AN EXPERT. THIS SUGGESTS THAT THE GREATEST DEMAND IN TELEVISED INSTRUCTION TO TEACHERS IS FOR FEEDBACK. (OH)

A
EM 006 148

ED020667

INSTITUTE FOR COMMUNICATION RESEARCH
STANFORD UNIVERSITY

THE PEACE CORPS
EDUCATIONAL TELEVISION (ETV) PROJECT
IN COLOMBIA -- TWO YEARS OF RESEARCH.

Research Report No. 6:
Instructional Television for the In-Service Training of the Colombian Teacher

By George Comstock and Nathan Maccoby

Institute for Communication Research
Stanford University
November, 1966

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

EM006 148

This research was conducted under Peace Corps Contract No. W-276, entitled, "To Provide Continuous Information on the Effectiveness of the Peace Corps Educational Television (ETV) Project in Colombia." This is one of 12 volumes in a series, The Peace Corps Educational Television Project in Colombia--Two Years of Research. Titles of the other volumes and some brief facts on the ETV Project and on the research can be found at the end of this report.

CONTENTS

Page

Introduction 1

Organization of the Report 2

Part I: Three Studies: Effectiveness and Context of Televised Instruction for Teachers 2

- The Background 2
- The Data-Gathering 4
- The Bogota Research 5
- The Medellin Research 9
- The Tolima and Huila Research 16
- A Methodoligical Problem 19
- Summary and Discussion 21

Part II: A Follow-Up Study: What Teachers Want from Televised Instruction 24

- The Background 24
- The Test 24
- The Questionnaire 24
- The Sample 25
- Test Administration 25
- Test Performance and Viewing 26
- More Evidence on Course Effectiveness 26
- The Size of the Audience 27
- The Context of Viewing 30
- What Do the Teachers Think of Televised Instruction for Teachers? 33
- How Can These Teachers Be Induced to Use ETV? 35
- What Kind of Aids Do the Teachers Feel Would Help Them Learn Via ETV? 36

CONTENTS (cont'd.)

Page

What Is the Role of Discussion? 40

Discussion and Test Performance. 45

Summary and Discussion. 50

Footnotes 53

Appendix 55

Reports Published in This Series at end

Brief Facts: The ETV Project, and the Research at end

One of the principal tasks of the Peace Corps Educational Television (ETV) Project in Colombia is to provide high quality televised instruction for primary school pupils. Another, and equally important task, is to improve the teaching of Colombian primary school teachers. Hopefully, the instruction telecast for the pupils has itself been able to improve teaching in the classroom by providing the teachers with an example - the television teacher - whom they might emulate. A more direct attack has been underway since the initiation of the ETV Project at the beginning of 1964 in the form of special telecasts for the teachers. The research reported here is concerned with the _first_ complete course to be telecast for the teachers on a subject which they are expected to teach in the primary schools --- a 17- telecast course on the "new math" called "Mathematics for Teachers." This course was presented during the third semester of the ETV Project (February-June, 1965). One question we attempted to answer was: How effective was the course? However, we also attempted to answer some even more important questions: Under what conditions, or in what _context_, is such a course most effective? What role might the Volunteer play in such instruction? What place might such a course have in the curriculum of the Colombian Normal (teacher training) school? What kinds of teaching aids--as a complement to the televised instructions--do the teachers want? What objections do the teachers have to televised instruction for their own training? How might teachers doubtful about the worth of such instruction be induced to take part? What role might the Volunteer play in increasing the teacher audience for further professional training by television?

Organization of the Report

The report is in two parts. In the first, three related studies are reported which deal directly with effectiveness of the course and the context in which it seemed to be most effective. In the second, a follow-up study is reported which deals in more detail with the context in which televised instruction for teachers is most effective, and examines what teachers want from such instruction and the implications of teacher objections and doubts for increasing the teacher audience.

PART I: Three Studies: Effectiveness and Context of Televised Instruction for Teachers.

The Background: "Mathematics for Teachers," often simply called the "new math" course, consisted of 17 programs telecast at the rate of two a week during the first half of 1965.[1] It was the first of several such televised courses for teachers -- courses in subjects they must teach their pupils, and which are included in the televised curriculum for pupils around which teachers using ETV are expected to build their own teaching.[2] It has a particular importance, for it was the latest of a variety of attempts since the beginning of the project a year before to find a successful formula for teacher training by television. Outside of instruction in building teaching around ETV, initial efforts consisted of single programs on such topics as child psychology and sources for free or inexpensive teaching aids. Later efforts were single programs concerned with classroom management, and theories and philosophies of teaching. Almost all were lectures or round-table discussions. By all reports, teachers who watched found them dreary. More important, most did not watch. The programs could only be scheduled during time normally free to the teacher, and they failed to engender sufficient enthusiasm for teachers to give up their time.[3] Whatever their intrinsic merits, they were a great disappointment. At the end of the first semester of the ETV Project (February-June, 1964), not a single Volunteer working among teachers reported finding a way to induce teachers to watch these programs.[4] As a result, it was decided to shift the content of the programs from the broad and general to the specific and practical---to give the teachers instruction in academic subjects and new ways of teaching them, which the teachers themselves teach every day. The "new math" seemed a natural starting point for such a series. Televised "new math" for pupils had been introduced in all five of the primary grades, and the teachers had voiced considerable anxiety about their ability to understand it, much less teach it. It seemed to be a subject about which they really wanted to know more. At the same time, because a course (instead of self-contained programs) was to be telecast, Departmental (state) and local school officials vehemently urged teachers to watch. Before, their support had been only tacit. And there was another innovation: the Volunteers working with teachers undertook to organize them into viewing groups.[5] On the one hand, it was hoped that commitment along with others to watch, and the social atmosphere of group viewing, would increase the likelihood of viewing after the initial telecast. On the other hand, it was hoped that viewing in a group would provide a more favorable environment for learning, for the Volunteers also intended to encourage the teachers to discuss the material among themselves after each telecast, so that each group would constitute an informal class. Overall, "Mathematics for Teachers" constituted a new kind of attack for the ETV Project on teacher training by television. The situation clearly called for whatever research was feasible.

The Data-Gathering: Three closely related studies are reported in this section. They were undertaken as soon as it became clear that "Mathematics for Teachers" had won a fair-sized audience, and that the Volunteers had had some success in organizing viewing groups. The studies have a common focus---the effectiveness of the course, and the context in which it was most effective. However, the kinds of persons involved, and the circumstances in which viewing occured, were quite different. As a result, what can be learned from each is different. Probably the studies can be best distinguished by area. The teachers were:

a) Forty-four teachers in Colombia's capital of Bogota, in a complex of schools in the low-income Alliance for Progress suburb of Ciudad Kennedy;

b) Eighty-one teachers in 12 different schools in Medellin, Colombia's second largest city and capital of the Department of Antioquia;

c) Eighty-six students in five classes at four Normal (teacher training) schools in communities in the Departments of Tolima and Huila.[6]

To all of these teachers and prospective teachers, an exam covering the content of "Mathematics for Teachers" was administered at the end of the course. In Bogota, the teachers could be classified as to the amount of their viewing; in Medellin, the teachers viewed in Volunteer-organized groups, and these varied in a variety of ways in addition to amount of viewing; in Tolima and Huila, the Normal school students varied not only in the amount of their viewing, but in whether or not the televised course was used as a supplement to a regular class in the "new math." Because of the newness of the kind of attack represented by "Mathematics for Teachers," and the great uncertainty as to how well it would be received, differences in amount of viewing and in the context of viewing could be determined only after the fact, concurrent with the administration of the exams.

The exam used in Bogota consisted of 26 multi-part items with a maximum score of 97. On the basis of the results in Bogota, the exam was reduced to 20 items with a maximum score of 75 for use in Medellin and Tolima and Huila. The items were open-ended, so there was no "chance" score; some items called for definitions, others for problem-solving.[7]

The Bogota Research: The principal concerns at Ciudad Kennedy were a) the effectiveness of the televised instruction, and b) the quality of the test itself, which was to be administered as soon as possible afterwards in Medellin and Tolima-Huila. Of course, obtaining useful information on the former depended on the latter. Fortunately, although a few revisions seemed desirable, the test proved to be quite satisfactory. When the teachers took the test, they also provided information on the amount of their viewing and on personal characteristics---

age, sex, years of teaching experience, and education.[8] Selected for testing were all second through fifth grade teachers at two schools in the Ciudad Kennedy school complex.[9]

On the basis of the teachers' replies, it was possible to form five groups each of which varied in amount of viewing: those who reported viewing a) 13-17, or all or almost all, the programs; b) 8-12, or one half or more, of the programs; c) 4-7, or some of the programs; d) 1-3, or very few of the programs; and e) none of the programs. The test results for those groups are shown in Table 6:1.

As can be seen, there is a clear relationship between test performance, which presumably reflects knowledge of the "new math" such as that imparted by the televised course, and exposure to the course. A one-way analysis of variance, which provides an overall test of the differences between all the means at one time, is statistically significant ($p < .01$), so that individual pairs of means may be compared.

Table 6:1. Bogota (Ciudad Kennedy) Teacher Math Test Results - the Effectiveness of the Televised Course

Group	Television Exposure	N	Average Score	(Maximum Possible = 97)
a)	13-17 programs (all or almost all)	9	69.7	
b)	8-12 programs (one-half or more)	10	54.5	
c)	4-7 programs (some)	16	54.9	
d)	1-3 programs (very few)	4	38.8	
e)	no programs (no TV)	5	31.6	
		44		

(Continued)

Table 6:1. (Continued)

One-way Analysis of Variance for above scores:

Source	Sum of Squares	Degrees of freedom	Variance Estimate
Between	5,589	4	1,397.25 = s^2_b
Within	11,522	39	295.44 = s^2_w
Total	17,111	43	

$$F = \frac{s^2_b}{s^2_w} = 4.729$$

$p < .01$

Selected Contrasts between above scores:

Condition With Expected Higher Score	vs.	Condition With Expected Lower Score	Difference	Level of Significance (one-tailed test)
1. a) all or almost all viewed (Mean = 69.7)		e) no TV viewed (Mean = 31.6)	38.1	$p < .005$
2. a) "		d) very few viewed (Mean = 38.8)	30.9	$p < .005$
3. a) "		b) one half or more viewed (Mean = 54.5)	15.2	$p < .05$
4. all TV viewing (a,b,c,d combined) (Mean = 56.5)		e) no TV viewed (Mean = 31.6)	24.9	$p < .005$
5. some, or more viewed (a,b,c combined) (Mean=58.6)		d) very few viewed (Mean = 38.8)	19.8	$p < .025$

Thus, the performance of those who saw the complete course may be compared with that of those who saw none of it: the mean of the all or almost all group is 69.7, the mean of the none group is 31.6, and the difference of 38.1 points is significant ($p < .005$). The performance of those who saw the complete course may also be compared with that of those who saw only a small part of it: the mean of the all or almost all group is 69.7, the mean of the very few group is 38.8, and the difference of 30.9 points is also highly significant ($p < .005$). Even relatively small differences in exposure were associated with a marked difference in test performance. When those who saw the complete course (the all or almost all group), with a mean of 69.7, are compared with those who most closely approach them in exposure (the one-half or more group) with a mean of 54.5, the difference of 15.2 points is significant ($p < .05$).

Under these circumstances, it will hardly be surprising that when the performance of all of those who had some exposure (the four TV groups combined, with a mean of 56.6), whatever the amount, is compared with those who had no exposure (the none group, with a mean of 31.6), the difference (24.9 points) is highly significant ($p < .005$). It will also hardly be surprising that when the performance of the three TV groups which had more than minimum exposure (the three higher exposure groups, with a combined mean of 58.6) is compared with that of the minimum exposure group (the very few groups, with a mean of 38.8), the difference (19.8 points) is significant ($p < .025$).

In short, the conclusion is unambiguous: If a teacher saw any of the classes, he was likely at the end to possess more mathematics knowledge than one who saw none of the classes. The more classes a teacher saw, the more knowledge of the subject he was likely to possess at the end. This particular televised course --- "Mathematics for Teachers" --- would appear to be highly effective.

The Medellin Research: Here, it was possible to obtain some information on the context in which televised instruction for teachers might prove most effective. This was made possible by the fact that the teachers in Medellin were organized into small groups by Volunteers for viewing the programs at their schools, and these groups differed not only in the amount of their exposure to the course but in the circumstances or context in which exposure occurred. Thus, it is possible to examine the test performance, or learning, of these groups in the light of these differences.

Test data and information of the circumstances of viewing were obtained on 12 groups, with a total of 81 teachers. Four variables which might affect learning could be distinguished. One was exposure to the course, which varied among the 12 groups. The other three involved the context of this exposure: a) whether there was supervision of and participation in the group by a Volunteer; b) whether there were discussion sessions immediately following each telecast on the material covered in that telecast; and, c) whether each teacher kept a notebook of the material covered in the course. The information on the circumstances of viewing was supplied by the Volunteers, who also administered the tests. This information was quantified, and on its basis the 12 groups were ordered from least to most in their possession of attributes likely to be associated with greater learning. The results appear in Table 6:2. Only one group (NO. 11) failed to fit perfectly the resulting cumulative scaling of the groups. After the groups had been ordered, the test results were matched to the groups.

It is quite apparent that this particular ordering of the groups and the way they would be ordered by test scores alone are related. The rank order (rho) correlation between ordering the groups by attributes and by test scores is .826 ($p < .01$). The possession of these attributes relates positively to test performance.

As before, exposure to the televised lessons is clearly related to test performance. For example, when the six groups which viewed all or almost all of the programs, with a combined mean of 38.3, are compared with the six with less exposure, with a mean of 19.4, the difference of 18.9 points is highly significant ($p < .001$). Other comparisons based solely on exposure (the 10 all or almost all and the not all, but quite a few groups vs. the two very few groups, and the six all or almost all groups vs. the two very few groups) also are significant ($p < .001$). The effectiveness of the televised "Mathematics for Teachers" seems to be again demonstrated. The teachers learned from the course. However, this would be expected after the Ciudad Kennedy results. The more important aspect of this research is that it provides at least a modest opportunity to examine effects of the context of this televised instruction.

Unfortunately, and aside from the possibility that differences in scores and behavior reflect innate differences, the attributes of the

Table 6:2. Medellin Teacher Math Test Results -- the Context of Television Instruction

Group I.D.	Television Exposure	Volunteer Supervision	Keeping of Notebooks	Discussions of Material	N	Average Score (Max. = 75)
8	3	2	1	1	5	41.2
3	3	2	1	1	9	39.4
12	3	2	1	1	6	34.8
9	3	1	1	1	7	38.7
1	3	1	1	1	5	53.8
11	3	0	1	1	5	21.8
7	2	1	1	0	6	24.0
2	2	1	0	0	8	17.5
4	2	0	0	0	5	30.0
6	2	0	0	0	8	13.8
10	1	0	0	0	7	13.4
5	1	0	0	0	10	21.5
					81	

Code: TV Exposure: 3 = All or almost all televised sessions (13-17 programs)
2 = Not all, but a fourth to three-fourths (4-12 programs)
1 = Less than one-fourth (0-3 programs)

Volunteer Supervision: 2 = All or almost all sessions (8-17 sessions)
1 = Occasionally (1-7 sessions)
0 = Not at all (0 sessions)

Keeping Notebooks: 1 = Kept Notebooks
0 = Did Not Keep Notebooks

Discussion: 1 = Engaged in discussions after each telecast
0 = Did not engage in discussions after each telecast

One-way Analysis of Variance of above scores:

Source	Sum of Squares	Degrees of Freedom	Variance Estimate	
Between	11,229.5	11	1,020.86	$= s^2_b$
Within	11,511.5	69	166.83	$= s^2_w$
Total	22,741.0	80		

$$F = \frac{s^2_b}{s^2_w} = 6.119$$

$p < .001$

(Continued)

Table 6:2. (Continued)

Selected Contrasts between above scores:

(1) Condition With Expected Higher Score	(2) Condition With Expected Lower Score	(3) Difference	(4) Level of Significance (one-tailed test)
1. max. TV exposure Group 8,3,12,9,1,11 (M = 38.3)	less TV exposure Group 7,2,4,6 10,5 (M = 19.4)	18.9	$p < .001$
2. max. TV exposure with max. PCV supervision Group 8,3,12 (M = 38.5)	max. TV exposure with less PCV supervision Group 9,1 (M = 45.0)	-6.5	n.s.
3. notebooks, some TV Group 7 (M = 24.0)	no notebooks, some TV Group 2,4,6 (M = 19.1)	4.9	n.s.
4. PCV supervision, max. TV Group 8,3,12,9,1 (M = 40.9)	no PCV supervision, max. TV Group 11 (M = 21.8)	19.1	$p < .01$
5. max. TV, no PCV supervision Group 11 (M = 21.8)	less TV Group 7,2,4,6 (M = 20.2)	1.6	n.s.
6. max. TV, max. learning effort Group 8,3,12 (M = 38.5)	min. TV, min. learning effort Group 10,5 (M = 18.2)	20.3	$p < .001$

A one-way analysis of variance of the scores of the 12 groups is significant ($p < .001$). Thus, selected contrasts between means may be made.

groups are not ideally arranged for purposes of inference. For example, it is impossible to separate exposure to the course from post-telecast discussion. However, there _is_ a clear relationship between Volunteer supervision and discussion, as is shown in _Table 6:3_, and between Volunteer supervision and exposure itself, as is shown in _Table 6:4_. In regard to post-telecast discussion, of the seven groups with Volunteer supervision, five engaged in such activity, but of the five without supervision, only one did so. In regard to exposure, of the seven groups with Volunteer supervision, five saw _all_ or _almost all_ of the programs, but of the five without supervision only one had such exposure. Supervision by the Volunteer seemed to have been essential to insure an audience participating actively in learning. Increased exposure alone, without supervision, does not seem to guarantee increased learning; when the one top exposure group without supervision (No. 11), with a mean of 21.8, is compared with the four groups with less exposure, with a combined mean of 20.2, the difference of 1.6 points is not significant.

Yet, there is some evidence that Volunteer supervision need not involve attendance at every viewing session. When television exposure is uniform---_all_ or _almost all_---and the performance of those receiving constant Volunteer supervision, with a mean of 38.5, is compared with that of those receiving only occasional Volunteer supervision, with a mean of 45.0, the difference of 6.5 points is in the opposite direction of what might be expected and is not significant. Apparently, some _Volunteer attention, but not total attention, is necessary_ for maximum effectiveness with teachers. There is also some slight evidence regarding

Table 6:3. Volunteer Supervision and Post-Telecast Discussions of Lesson Content

	Post-Telecast Discussion:		
	Took Place	Did Not Take Place	
With Volunteer Supervision	5 groups (32 members)	2 groups (14 members)	= 7 (46)
Without Volunteer Supervision	1 group (5 members)	4 groups (30 members)	= 5 (35)
	6 (37)	6 (44)	= 12 (81)

Table 6:4. Volunteer Supervision and Exposure to the Televised Lessons

	Viewed:			
	All or Almost All	Not All But Quite a few	Very Few	
With Volunteer Supervision	5 groups (32 members)	2 groups (14 members)	none (-)	= 7 (46)
Without Volunteer Supervision	1 group (5 members)	2 groups (13 members)	2 groups (17 members)	= 5 (35)
	6 (37)	4 (27)	2 (17)	= 12 (81)

the effectiveness of the kind of notebooks kept: when the television exposure is uniform --- for the not all, but quite a few groups --- and for the one group which kept notebooks, with a mean of 24.0, are compared with the three which did not, with a mean of 19.1, the difference of 4.9 points, although in favor of the notebook group, is not significant. Probably, this reflects the nature of the notebooks, which were closer to detailed copybook records than meaningful, individualized syntheses.

The beneficial effect of what might be termed the "full treatment" is apparent when either the three "top" groups (with all or almost all exposure and full supervision), with a mean of 38.5, or the two next to the "top" groups (with all or almost all exposure and partial supervision), with a mean of 45.0, are compared with the "bottom" two groups with a mean of 18.2. In both cases the differences---of 20.3 and 26.8 respectively---are significant ($p < .001$).

In sum, the Medellín experience in regard to teacher instruction by television suggests that without supervision by the Volunteer, there is neither great exposure nor discussion. Since discussion results in practice of the material to be learned, and the clarification of ambiguities or misunderstandings, it is very likely that it contributes to learning. However, that is speculation. That discussion and exposure seem to be part of a Volunteer-associated "package" is not speculation, but a fact. It also seems likely that the energy devoted to notebook keeping was unproductive.

The Tolima and Huila Research: The Colombian Normal schools are secondary schools devoted to the training of teachers. They are the major source of public school teachers, and, therefore, they are an appropriate target of any program concerned with educational reform. The televised "Mathematic for Teachers" course provided an opportunity to introduce televised instruction into Normal schools. However, there was no broad attack, for there were not enough Volunteers to work both in Normal schools and the primary schools using ETV, numbering over 800 at this time. Instead, the use of the televised course depended on the initiative of individual Volunteers in finding and working with willing Normal schools. This research was made possible because a single Volunteer had been working exclusively in Normal schools---and, among other things, had been giving instruction on teaching' with television---in the Departments of Tolima and Huila, and because the classes of these schools varied in their use of the televised mathematics course.

Test data were obtained from five classes in four schools located in four communities---Neiva and Gigante in Huila, and Villahermosa and Chaparral in Tolima. The Volunteer visited these schools regularly from Ibague, the capital of Tolima ---in some cases by air taxi because of inadequate roads and the threat of banditry. The five classes varied as to whether the TV course was viewed as a supplement to a concurrent class in modern mathematics; three did so; one had no math course in the school, but viewed some programs; and one was taking a math course in the school but did not have access to the televised course.

The exclusion of the latter group from television exposure was complete, because there was no TV set, a consequence of the near-impossibility of adequate reception. The classification of these classes and their test results are shown in Table 6:5.

A one-way analysis of variance is significant ($p < .001$). Clearly, television as a supplement would seem to have increased test performance, or learning: when the three classes which used the television math course as a supplement to their regular modern math instruction, with a mean of 29.4, are compared with the one class taking a similar course without television supplementation, with a mean of 14.5, the difference of 14.9 points is highly significant ($p < .005$). The data also hint at the relative limits of mere exposure: the test performance of the one class which viewed a few programs but was not concurrently studying modern math is extremely low---6.5; the performacne of the three television-supplemented classes (29.4) is several times better, and the difference (22.9 points) is highly significant ($p < .005$).

The Tolima and Huila results suggest that the use of the televised course was a valuable supplement to the Normal schools' modern math courses. They also cast some light on the Medellin results. In Medellin, it was not possible to separate exposure from post-lesson discussion as a source of learning. In Tolima and Huila, the regular math course may be considered analogous to post-lesson discussion because its functions are similar: practice and clarification. In Tolima and Huila, the television course itself clearly contributed much to greater learning. It is unfortunate that the one class not taking modern

Table 6:5. Tolima-Huila Normal School Teacher Math Test Results---
the Use of Television as a Curriculum Supplement

School I.D.**	Television Use	'New Math' in Curriculum	N	Average Test Score (Maximum Possible = 73)
2	Yes-full	Yes	17	19.5
3*	Yes-full	Yes	10	22.2
5	Yes-full	Yes	23	39.4
4*	Yes-part	No	8	6.5
1	No	Yes	1	14.5
			86	

*same school: 3 = 5th year class; 4 = 6th year class
**except as noted all are 5th year pupils

One-way Analysis of Variance of above scores:

Source	Sum of Squares	Degrees of Freedom	Variance Estimate
Between	10,540.4	4	2,635.04 = s^2_b
Within	4,240.6	81	52.35 = s^2_w
Total	14,781.0	85	

$$F = \frac{s^2_b}{s^2_w} = 50.34$$

$p < .001$

Selected Contrasts between above scores:

Condition With Expected Higher Score	vs.	Condition With Expected Lower Score	Difference	Level of Significance (one-tailed test)
1. TV Math w/ Math class (2,3,5 combined) M = 29.4		1. Math class w/o TV Math (1) M = 14.5	14.9	$p < .005$
2. "		4. TV Math w/o Math class (4) M = 6.5	22.9	$p < .005$
3. TV Math w/ Math class, same school (3) M = 22.2		" (same school) (4) M = 6.5	15.7	$p < .001$

math as part of the Normal school curriculum did not have complete exposure, so that its score could be used as a standard for assessing the contribution of the Normal school classes. Under the circumstances, it can only be said that exposure to the television course was associated with superior test performance, and that the best performance of all came from the students exposed to the television course plus a class in math, like the television course plus discussion in Medellin.

A Methodological Problem: It is regrettable that subjects could not have been randomly assigned to various conditions of exposure and complementary activity in these three studies. This would have at least three important benefits: a) it would have eliminated concern over the issue of self-selection into the conditions by the subjects themselves, thus restricting interpretation of the results; b) it would have permitted the addition of other context variables, and c) it would have made possible better control over behavior and thus the gaining of superior information on the variables involved. However, random assignment was not possible; the research was restricted to what occurred; the circumstances of this particular aspect of the ETV project precluded manipulation. After all, the obtaining of any audience at all was for a time problematical.

As to self-selection, the issue is whether exposure or complementary activity might not have varied as a result of some other variable, such as interest in, aptitude for, or even knowledge of the "new math", which itself might explain differences in test performance. The data themselves suggest that this is unlikely. For one thing, if self-selection had been a principal factor, it would be expected that it would be reflected in differences in the personal characteristics of the teachers in the various conditions. Yet, in both Bogota and Medellin, there was no relationship between sex, age, education, or teaching experience and presence in any of the conditions. It would be rare for an attitudinal variable to be entirely without such demographic correlates. Moreover, the superior test performance with each increase in exposure in the five group Bogota results would suggest that a self-selection variable would have a positive relationship to test performance and a negative relationship to viewing in order to explain entirely all the results. The pervasive operation of such a variable seems unlikely. In Medellin, of course, the self-selection problem is mitigated by the use of viewing groups whose members teach in the schools where they watched TV. Concentrations of math buffs seems unlikely. However, the possible role of promised teacher cooperation in inspiring Volunteer attention can hardly be ignored. In Tolima and Huila there was no self-selection problem, since the pupils could not have selected schools for televised math instruction. They did not know they would receive it when they enrolled; the students in any school came almost entirely from the local area; and any television exposure for the non-television class was impossible. Overall, as regards the effect of exposure, the consistency of the results also argue against self-selection as a complete explanation.

As to he utilitity of the research, it was restricted by the confounding of variables and the limit on their variety. This is an unfortunate but unavoidable short-coming. Hopefully, any future work on televised instruction for teachers in Colombia, can involve better controls and a wider range of variables.

Summary and Discussion: Three researches on the televised "Mathematics for Teachers" course provide information on the effectiveness of this course, the most effective context for televised instruction, and its use in Normal schools.

1) In Bogota, tests administered to 44 teachers made clear that exposure to the televised course was clearly related to superior performance on a modern math test. Within the limit of its content goals, the course clearly seems to have been a potent success.

2) In Medellin, a study of 81 teachers in 12 groups, organized to take advantage of the televised course, provided similar evidence of the effectiveness of the televised instruction. Three variables in addition to exposure were examined: a) Volunteer supervision; b) post-lesson discussion; and c) the keeping of notebooks. Most productive for learning was a combination of high exposure and discussion. Unfortunately, the effects of these two could not be separated. However, the data suggested that Volunteer supervision seemed to promote learning, for added exposure without supervision was not associated with superior test performance. Moreover, Volunteer supervision seemed to be essential to promote both exposure and discussion. However, some or occasional supervision was sufficient for this purpose. The keeping of notebooks seemed to contribute little to learning, probably because the notebooks were not syntheses, but merely copy-books.

There are many hints in the Medellin results for future action. The first is that the group viewing plan holds considerable promise. The second is that without Volunteer attention in the group situation, the effectiveness of televised instruction is much reduced. This suggests that the effectiveness of television instruction for teachers is limited by Volunteer or other supervisory resources. Third, it suggests that a careful distributing of Volunteer attention can increase Volunteer productivity in this area. (Why full supervision, if some will do?) Fourth, the usefulness of the notebooks, if teachers want to keep them, probably can be increased. It is possible that problem books or review (self-graded) tests should be substituted, or perhaps some modest form of programmed instruction.

3) In Tolima and Huila, a study of five classes in four Normal Schools again provided evidence of the effectiveness of the televised instruction. More important, it also indicated that the televised course when used as a supplement to regular classes increased learning of modern math.

No comparisons were made between the Bogota, Medellin or Tolima and Huila results because of differences in time between administration of the tests and the end of the televised course, and because the three tests were not the same (the Bogota test was revised for use in Medellin and Tolima-Huila). The Bogota tests were administered immediately after the end of the course, and the Medellin and Tolima-Huila tests approximately three weeks later. Of course, the clear benefits of the televised instruction after the passage of several weeks in the latter two instances is a further indication of its effectiveness.

In short, the televised instruction of "Mathematics for Teachers" was very effective, but Volunteer effort was necessary to maximize its effect. It is likely that the same would be true of other televised instruction. The problems raised are intriguing for future consideration: the improvement and expansion of the context for televised instruction, and development of effective motivating devices.

PART II: A Follow-Up Study: What Teachers Want from Televised Instruction.

The Background: As a result of these three studies on the televised modern math instruction for teachers, the Colombian Director of Educational Television[10] requested that a modern math test be prepared which could be administered to teachers on a wide basis. We agreed to prepare such an exam, and to analyze the results, if the Director could arrange for distribution and administration. This the Director was able to do through school officials. To take maximum advantage of this situation, we added to the test a questionnaire on amount of viewing and on how the teachers felt about receiving instruction by television. In the questionnaire, we sought answers to these questions: How successful was the televised instruction? In what behaviors in addition to viewing did the teachers engage in order to learn from the televised course? What kinds of instructional aids in addition to the telecasts do the teachers want? What do the teachers think of televised vs. in-person instruction? What are some of the objections which must be overcome before teachers cynical of televised instruction will use the medium?

The Test: The test was identical in content covered to that used in the previous research, except that the items were converted from completion-type to four-alternative multiple choice items and a separate answer sheet used to facilitate correcting a large number of exams. There were 72 items.

The Questionnaire: The questionnaire was attached to the answer sheet. It sought information on the following: demographic data (age, education, teaching experience, etc.); amount of viewing of the televised course; the context in which viewing took place---whether there was note-taking, post-lesson discussions with other teachers, or Volunteer supervision of the viewing group; opinions in regard to instructional aids---whether discussions, Guides, other printed material, special exercises, opportunity to question an expert or participate in a conference led by an expert were considered useful; and attitudes toward televised vs. in-person instruction. (For items, see Appendix.)

The Sample: The test and questionnaire were completed by 1,003 teachers in 144 schools in Bogota and 338 teacher in 48 schools in the Department of Cundinamarca, a total of 1,341 teachers. The Bogota sample represents approximately one-half of all primary public school teachers in the city. The Cundinamarca sample represents all primary teachers in the towns in which the test was given. Sampling was determined by the capacity of supervisors to reach the schools in their zones in a one-week period. However, all teachers in any participating school were covered. Throughout the analysis the Bogota and Cundinamarca samples are combined. The size and breadth of the sample argues against any serious biases, but it definitely does not permit an unequivocal probability estimate of the characteristics of the larger teacher population.

Test Administration: The tests were taken independently by the teachers in their own schools, and the degree of supervision varied from school to school. It cannot be said that the tests were administered under satisfactorily controlled conditions. The tests were taken five weeks after the math telecasts were completed.

Test Performance and Viewing: Overall, the mean score for the 1,341 teachers was 55.4 (the maximum possible was 72). Since the teachers also indicated how many of the modern math telecasts they had seen, it is possible to compare test performance with the amount of viewing, as well as to obtain some idea as to the audience for the course. These data appear in Table 6:6. As before, test performance was clearly related to viewing. In general, the more telecasts a teacher had seen, the better the score he was likely to make.

More Evidence on Course Effectiveness: The average score for teachers who saw none of the telecasts was 52.1; for teachers who saw some (1-7 telecasts), 53.7; for teachers who saw about half (8-10 telecasts), 58.6; for teachers who saw almost all (11-16 telecasts), 58.2; and, for teachers who saw all (17 telecasts), 60.4. A one-way analysis of variance, which tests the differences between all the groups at one time, indicates that the differences are unlikely to be the result of chance variations ($p < .001$). As a consequence, it is possible to contrast selected differences between the groups. These comparisons are all statistically significant: a) the 8.3 point difference between the mean of 60.4 of those who saw all and the mean of 52.1 of those who saw none ($p < .001$); b) the 4.3 point difference between the combined mean of 56.4 of those who did any viewing at all and the mean of 52.1 of those who saw none ($p < .001$); c) the difference of 5.0 points between the mean of 60.4 of those who saw all and the mean of 55.4 of the other (lesser viewing and none) groups combined ($p < .001$);

d) the difference of 2.2 points between the mean of 60.4 of those who saw all and the mean of 58.2 of those who saw almost all ($p < .05$); e) the difference of 1.6 points between the mean of 53.7 of those who saw some and the mean of 52.1 of those who saw none ($p < .01$).

These results are particularly impressive for two reasons: a) test taking was not arduously supervised, and probably cheating was generally easy; b) some of the teachers---according to reports concentrated in the lower viewing groups---had taken a special short course in modern math sponsored by the National Ministry of Education. Both of these factors would tend to reduce any positive association between viewing and test performance, yet differences unlikely to be the result of chance variations nevertheless occur. The results give further support for the effectiveness of the televised math course.

The Size of the Audience: As to the audience, it can be seen (Table 6:6) that 3.8 per cent (51) of the teachers reported viewing all the programs, and 25.4 per cent (340) reported viewing almost all the programs. Thus, 29.2 per cent (391) or almost one-third, could be called "regular watchers". The per cent which reported viewing about half was 15.3. Thus 44.5 per cent (596) viewed half or more of the telecasts. Only 18.6 per cent (250) reported viewing none of the programs; questionnaire responses for the 3 per cent (40) who did not report on their viewing most closely resembled the replies of the declared non-viewers; thus these should probably also be considered non-viewers. Thus, only about one out of five (290) were non-viewers.[11]

Table 6:6. Viewing of Modern Math Course and Performance on Modern Math Test

Viewing of televised math course:	Number (N) of teachers	Per cent teachers of total	Average test score
All*	51	3.8	60.4
Almost all	340	25.4	58.2
About half	205	15.3	58.6
Some	455	33.9	53.7
None	250	18.6	52.1
No response on viewing	40	3.0	47.9
Total:	1,341	100.0%	55.4

One-way Analysis of Variance for above scores:**

Source	Sum of Squares	Degrees of freedom	Variance Estimate
Between	10,014	4	2503.5 = s^2_b
Within	75,593	1,296	58.3 = s^2_w
Total	85,607	1,300	

$$F = \frac{s^2_b}{s^2_w} = 42.9$$

$p < .001$

**Excluding the "no response on viewing" group

---

*All = saw all 17 telecasts
Almost all = saw 11-16
About half = saw 8-10
Some = saw 1-7
None = saw no telecasts

(Continued)

Table 6:6. (Continued)

Selected Contrasts between above scores:

Condition with expected higher score	vs.	Condition with expected lower score	Difference	Level of significance (one-tailed test)
All (Mean = 60.4)		None (Mean = 52.1)	8.3	p < .001
All, almost all, About half and Some combined (Mean = 56.4)		None (Mean = 52.1)	4.3	p < .001
All (Mean = 60.4)		Almost all, About half, Some and None combined (Mean = 55.4)	5.0	p < .001
All (Mean = 60.4)		Almost all (Mean = 58.2)	2.2	p < .05
Some (Mean = 53.7)		None (Mean = 52.1)	1.6	p < .01

In short, the data suggest: a) that the instruction was highly effective; and, b) that viewing was quite widespread.

The Context of Viewing: Three variables involving the context in which the televised instruction was viewed were investigated: a) participation in post-lesson discussions; b) taking of detailed notes; and, c) supervision of the viewing group by Volunteers. The data, broken down by viewing groups, appear, for discussions, in Table 6:7; for notetaking, in Table 6:8; and, for Volunteer supervision, in Table 6:9.

Tables 6:7 and 6:8 should be examined together. First, it is clear that note-taking is far more common as a complement to televised instruction than is discussion with other teachers of the course content. Second, it is equally clear that viewing and participation in complementary activity are related; the less regularly a teacher views, the less likely is he to engage in discussions or take notes when he does view.

In Table 6:9, it can be seen that Volunteer supervision is positively related to viewing, that is, if a Volunteer supervised the group in which a teacher viewed, the teacher was more likely to view more often. For these who viewed all the telecasts, 33.3 per cent reported viewing under some degree of Volunteer supervision; for those who viewed only some, 20.5 per cent did so.

The data suggests: a) that regular viewing can facilitate other potentially productive learning behavior, such as notetaking and discussion; and, b) that Volunteer supervision promotes viewing.

Table 6:7. Participation in Post-Lesson Discussions and Viewing

Discussion Participation:

Exposure	After all programs	After almost all programs	After about half the programs	After less than half the programs	N
All	74.0 (37)	14.0 (7)	6.0 (3)	6.0 (3)	50
Almost all	10.3 (31)	69.4 (209)	11.9 (36)	8.3 (25)	301
About half	3.2 (6)	4.2 (2)	71.1 (135)	21.6 (41)	190
Some	4.9 (18)	5.4 (20)	10.8 (40)	78.8 (291)	369
All above	10.2 (92)	26.3 (238)	23.7 (214)	39.8 (360)	904

Table 6:8. Taking of Notes on Televised Lessons and Viewing

Exposure	Took notes	Did not take notes	N
All	91.8 (44)	8.3 (4)	48
Almost all	87.1 (284)	12.9 (42)	326
About half	86.0 (172)	14.0 (28)	200
Some	69.9 (293)	30.8 (126)	419
All of above	79.9 (793)	20.1 (200)	993

Table 6:9. Supervision by Volunteers and Viewing

Exposure	Never had PCV Supervision		Sometimes had PCV Supervision		Almost always had PCV Supervision		Always had PCV Supervision		N
All	66.7	(30)	28.9	(13)	2.2	(1)	2.2	(1)	45
Almost all	68.7	(227)	28.2	(93)	3.0	(10)	-		330
About half	79.5	(159)	19.0	(38)	1.5	(3)	-		200
Some	79.4	(323)	17.9	(73)	2.4	(10)	.2	(1)	407
All of above	75.2	(739)	22.1	(217)	2.4	(24)	.2	(2)	982

Table 6:10. Teacher Preference for Televised vs. In-person Instruction and Viewing

	Preference:						
Exposure	Prefer TV instruction		Prefer in-person instruction		Have no preference		N
All	30.0	(15)	62.0	(31)	8.0	(4)	50
Almost all	16.7	(56)	72.6	(244)	10.7	(36)	336
About half	10.4	(21)	78.1	(157)	11.4	(23)	201
Some	13.5	(60)	73.6	(326)	12.6	(56)	442
None	10.0	(24)	76.9	(184)	12.9	(31)	239
No response re: viewing	----		86.3	(19)	13.7	(3)	22
All of above	13.6	(176)	74.5	(961)	11.9	(153)	1290

What Do the Teachers Think of Televised Instruction for Teachers?

The teachers were asked two questions in regard to their attitudes toward televised teacher instruction. In one, they were asked to compare televised and in-person instruction: *Which did they prefer*? In the other, they were asked whether they thought televised instruction could be as effective as in-person instruction: *Could they learn as much by television*?

The data, broken down by viewing, is shown in *Table 6:10* in regard to preferences, and in *Table 6:11* in regard to belief in television teaching effectiveness.

It should hardly be surprising that the great majority of teachers express a preference for in-person instruction (*Table 6:10*.) Overall, 74.5 per cent say they prefer in-person instruction. However, it is noteworthy that the per cent preferring in-person instruction tends to decrease, and the per cent preferring televised instruction tends to increase, as viewing increases. Of those who viewed all the telecasts, 30 per cent said they actually preferred televised to in-person instruction; of those who saw almost all, 16.7 per cent; of those who saw about half, 10.4 per cent; of those who saw some, 13.5 per cent; and, of those who saw none, 10.0 per cent.

However, if the relationship between preference and viewing is noteworthy, the relationship between viewing and belief in the equal effectiveness of televised instruction is striking. As viewing increases, the per cent saying an equal amount can be learned from televised instruction and from in-person instruction rises from 32.4 per cent for those

Table 6:11. Belief in Effectiveness of TV Instruction

Belief in TV Instructional Efficacy

Exposure	Can learn same from TV classes as from in-person classes		Can not learn same from TV classes as from in-person classes		N
All	56.5	(26)	43.4	(20)	46
Almost all	43.6	(143)	56.4	(185)	328
About half	34.2	(68)	65.8	(131)	199
Some	33.6	(144)	66.4	(285)	429
None	32.4	(70)	67.6	(146)	216
No response re: viewing	22.7	(5)	77.3	(17)	22
All of above	36.8	(456)	63.2	(784)	1240

who viewed none of the telecasts to 56.5 per cent for those who viewed all of the telecasts.

Obviously, it is not possible to attribute the more favorable dispositions toward ETV of those who viewed more frequently solely to the modern math experience with the medium. It is quite possible that such dispositions existed prior to viewing, and were the cause of greater viewing. However, the relative lack of experience of Colombian teachers with television of any sort makes the former seem the more likely.

Whatever the interpretation of this relationship, it must be pointed out that overall, 63.2 per cent of the teachers said that televised instruction could not be as effective as in-person instruction. This suggests that there may be a very real psychological, or attitudinal, barrier to further increasing the size of the teacher audience.

How Can These Teachers Be Induced To Use ETV? The great promise of teacher instruction by television, coupled with the great need for further professional training, makes this an important question. The positive relationship between viewing and attitudes gives one hint. If a teacher can be persuaded, on any grounds, to follow through with a televised course once, the teacher may take a more favorable view of the medium and be more ready to take another televised course. Of course, the corollary to this should serve as a warning---inferior televised instruction might permanently turn teachers from ETV. Further important leads to overcoming teacher resistance can be found in the data on instructional aids which the teachers consider effective and on the relationship between participation in post-lesson discussion and attitudes, which appear next.

What Kinds of Aids Do the Teachers Feel Would Help Them Learn Via ETV?

The teachers were asked what instructional aids, in addition to the telecasts themselves, they thought would help them from television. This was done for two reasons. First, to find the wants of the teachers in regard to aids. Second, to find out whether such wants were related to past viewing, and thereby possibly obtain a hint as to the particular objections or unfulfilled wants of non-viewers.

Specifically, the teachers were asked to indicate those of the following, (they could check more than one), which they felt would help them learn more from ETV:

_____ Discussions with other teachers on course content

_____ A special printed Guide, such as that used with the modern math course

_____ Printed material in addition to the Guide

_____ Special problems and exercises for added private practice

_____ Opportunity to ask questions of an expert in the subject

_____ Participation in a meeting or class led by an expert in the subject

The results for the 1,341 teachers are shown in Table 6:12. As can be seen, the instructional aids most wanted were a conference or class given by an expert in the subject (48.2 per cent) and the opportunity to ask questions of an expert in the subject (44.4 per cent). The least wanted instructional aids were discussions (28.3 per cent) and special exercises (27.1 per cent). About one out of three teachers asked for additional material (35.7 per cent) or said they thought printed

Table 6:12. Instructional Aids in Addition to Telecasts Which Teachers Think Could Help Them Learn from Television

Instructional aid:	Per cent and number saying instructional aid could help them learn	
Discussions with other teachers on course content	28.3	(380)
Special printed Guide covering content such as that used with math course	30.2	(405)
Printed material in addition to Guide	35.7	(479)
Special problems and exercises for private additional practice	27.1	(364)
Opportunity to ask questions of an expert in the subject	44.4	(595)
Conference or class given by an expert in the subject	48.2	(647)

Base N = 1,341

Guides would be valuable (30.2 per cent).

In short, what the teachers most want is some sort of *feedback*. They want interaction with someone who can give them more help in the areas of which they are uncertain, and of whom they can ask specific questions. It is important to note the teachers' view of discussions. Although discussions with other teachers can fulfill many of the functions of such interaction, overall the teachers do not consider them sufficient.

Let us now turn to the question of the relationship between amount of viewing and the felt need for additional instructional aids. Does more TV viewing lead to less need for further help? In *Table 6:13*, the teachers' wants are broken down by viewing. Reading across, the preferences of each viewing group can be seen. For those who say they viewed *all* the programs, *all* aids are approved similarly, except for special exercises. For the other groups, opportunity to ask questions of or participate in a conference with an expert---that is, feedback---are markedly more preferred. *Moreover, this emphasis on the need for feedback seems not to decrease but actually to increase as viewing decreases*. Reading down, the preference for any single instructional aid of the different viewing groups can be seen. In regard to opportunity to ask questions of or participate in a conference with an expert, the high and low viewing groups are similar. Both express an approximately equal desire for feedback. However, in regard to discussions with other teachers on course content, the high and low viewing groups differ greatly: 45.1 per cent of the *all* group said that discussions

Table 6:13. Instructional Aids in Addition to Telecast Which the Teachers Think Could Help Them Learn and Viewing

	Instructional Aids:						
Viewing:	Discussions with other teachers on course content	Special Printed Guide such as used with math course	Printed material in addition to Guide	Special problems and exercises for private additional practice	Opportunity to ask questions of experts	Conference led by expert	Base N
All	45.1	41.2	41.2	29.4	47.1	43.1	51
Almost all	37.9	36.8	37.9	32.4	47.6	47.6	340
About half	30.7	39.0	44.4	36.6	56.6	56.6	205
Some	21.9	26.2	34.3	23.1	40.2	50.8	455
None	24.0	21.2	30.4	22.0	40.0	43.2	250
No response re: viewing	12.5	17.5	15.0	10.0	25.0	20.0	40
All of above	28.3	30.2	35.7	27.1	44.4	48.2	1341

could be helpful, but only 21.9 per cent of the some group and 24.0 per cent of the none group said this about discussions.

These data suggest: (a) that the teachers overall greatly desire feedback in connection with televised instruction, and that its absence is a principal objection to use of ETV; (b) that the teachers overall do not see discussion as a substitute, although it can serve many of the same functions; (c) that having once engaged in discussions --- as, it will be remembered, the more frequent viewers were more inclined to do --- the utility of discussion is more greatly appreciated. The hints are clear: one focus of any effort to expand the audience for teacher ETV must be the removal of the belief that ETV inevitably is without feedback; one likely way of increasing the belief that discussion --- which can provide feedback --- is useful, is to induce teachers to give it a sustained try.

What Is the Role of Discussion? These findings clearly focus attention on the role of discussion in promoting favorable attitudes in addition to being used as an instructional aid. The previous research suggested that post telecast discussion promoted learning, because of the feedback, active participation and clarification it offered. The new data provide an opportunity to further investigate the role of discussion.

In the tables which follow, it is possible to examine the effects of discussion alone when viewing was roughly the same; that is, within the limits of the data, viewing is "held constant". This is desirable because of the positive relationship between discussion and viewing;

otherwise, the effects of viewing and discussion would be hopelessly confounded.

The relationship between discussion participation and note-taking is shown in Table 6:14; between discussion and the belief in discussion as a useful instructional aid in Table 6:15; between discussion and preference for TV vs. in-person instruction in Table 6:16; and, between discussion and belief in the effectiveness of televised instruction in Table 6:17.

For all these tables, the all and almost all viewing groups are combined to form a "high" viewing group, and the about half and some groups are combined to form a "low" viewing group. For the high viewing group, "high discussion participation" means that a teacher engaged in discussions after all the telecasts which he saw; for the low viewing group, "high discussion participation" means that the teacher engaged in discussion after almost all or all the telecasts which he saw.[12] For each table, a Chi-square test of the likelihood of the observed relationship occuring by chance is presented.[13] For the pairs of tables (of high and low viewers) concerned with the same relationship, a combined Chi-square also is presented.

As can be seen, there is no relationship between discussion participation and note-taking. Low discussion teachers were about as likely to take notes as high discussion teachers. Thus, whatever relationships may be observed between discussion participation and other variables, they reflect the effects of discussion participation and not of note-taking.

Table 6:14. Discussion Participation and Note-taking as an Instructional Aid for High and Low Viewers

High viewers

Note-taking

Discussion participation	Yes	No	
High	92.4 (61)	7.6 (6)	= 100.0 = (66)
Low	86.0 (227)	14.0 (37)	= 100.0 = (264)

$X^2 = 1.207$

p = n.s.

Low viewers

Note-taking

Discussion participation	Yes	No	
High	78.0 (39)	22.0 (11)	= 100.0 = (50)
Low	76.1 (379)	23.9 (119)	= 100.0 = (498)

$X^2 = .090$

p = n.s.

Combined $X^2 = 1.297$

p = n.s.

Table 6:15. Discussion Participation and Belief in Effectiveness of Discussion as an Instructional Aid for High and Low Viewers

High viewers

Can discussion increase learning?

Discussion participation	Yes	No	
High	51.5 (35)	48.5 (33)	= 100.0 = (68)
Low	37.1 (105)	62.9 (178)	= 100.0 = (283)

$X^2 = 4.721$

$p < .025$

Low viewers

Can discussion increase learning?

Discussion participation	Yes	No	
High	30.8 (16)	69.2 (36)	= 100.0 = (52)
Low	24.9 (126)	75.1 (381)	= 100.0 = (507)

$X^2 = .871$

$p < .25$

Combined $X^2 = 5.592$

$p < .05$

Table 6:16. Discussion Participation and Preference for Televised vs. In-Person Instruction for High and Low Viewers

High viewers

Instruction preferred:

Discussion participation	TV	In-person	
High	31.6 (18)	68.4 (39)	= 100.0 = (57)
Low	14.8 (40)	85.2 (231)	= 100.0 = (271)

$X^2 = 9.152$

$p < .005$

Low viewers

Instruction preferred:

Discussion participation	TV	In-person	
High	22.0 (9)	78.0 (32)	= 100.0 = (41)
Low	14.2 (62)	85.8 (376)	= 100.0 = (438)

$X^2 = 1.805$

$p < .10$

Combined

$X^2 = 10.957$

$p < .005$

Table 6:17. Discussion Participation and Belief in the Instructional Effectiveness of Televised Instruction for High and Low Viewers

High viewers

Can as much be learned from TV as in-person instruction?

Discussion participation	Yes	No	
High	61.3 (38)	38.7 (24)	= 100.0 = (62)
Low	39.3 (108)	60.7 (167)	= 100.0 = (275)

$X^2 = 9.989$

$p < .005$

Low viewers

Can as much be learned from TV as in-person instruction?

Discussion participation	Yes	No	
High	52.1 (25)	47.9 (23)	= 100.0 = (48)
Low	33.4 (163)	66.6 (325)	= 100.0 = (488)

$X^2 = 6.697$

$p < .005$

Combined

$X^2 = 16.686$

$p < .0005$

In regard to discussion participation and belief that discussion can be useful, for the high viewers, discussion participation and belief in the utility of discussions are clearly related ($p < .025$). For the low viewing group, the same relationship appears, but the observed relationship does not escape the possibility that it could be occurring by chance ($p < .25$). Overall, the combined Chi-square suggests that discussion participation and belief in discussion's usefulness are related ($p < .05$).

In regard to preference for televised vs. in-person instruction, for the high viewers, preference for televised over in-person instruction is clearly related to discussion participation ($p < .005$). For the low viewers, the same relationship appears, but it also does not escape the possibility that it could occur by chance ($p < .10$). Overall, the combined Chi-square suggests that discussion participation and preference for television over in-person instruction are related ($p < .005$).

In regard to belief in the equal effectiveness of televised instruction, for both high ($p < .005$) and low ($p < .005$) viewers, discussion participation is clearly related to thinking that as much can be learned via television as by in-person instruction.

These data suggest: (a) that if a teacher engages in discussions of course content with other viewing teachers in connection with televised instruction, the teacher is more likely to think that such discussions can be useful; (b) that if a teacher engages in such discussion, the teacher is more likely to actually prefer televised over in-person instruction; and (c) that if a teacher engages in such discussions, the teacher is more likely to think that as much can be learned via television as from in-person instruction.

Probably, the explanation is this: teachers find discussions rewarding, and as the result of engaging in them find ETV itself more rewarding. The hint is clear: organizing and encouraging teacher discussion is a likely way of improving dispositions toward ETV. In short, *teacher discussion seems to be a powerful tool for improving the training of teachers by television*.

Discussion and Test Performance: The previous research on the modern math course suggests that teacher discussion can be highly effective as a *learning aid*. The present data do not contradict this. In *Table 6:18*, the test performance for high and low viewers as previously defined (with non-viewers excluded) is broken down by discussion participation. As can be seen when all viewers are examined together, the teachers who engaged in discussions after one-half or more of the telecasts they viewed. (Group 1, 2, 3) when taken together, performed better on the test than those who engaged in discussions less frequently. However, for neither viewing category is there an even progression of improved performance with increases in frequency of discussion participation. For the low viewers the trend is, in fact, opposite to what would be expected --- probably the result of the very small number of cases involved in the higher discussion categories, among which the presence by chance of a few unusually less able students would have a disproportionate effect. The statistical analysis is based on the combined results for all high *and* low viewers: a one-way analysis of variance of test

Table 6:18. Teacher Discussion and Test Performance

		Viewing					
		High Viewers		Low Viewers		All Viewers	
Group	Discussion participation:	Mean Test Score	N	Mean Test Score	N	Mean Test Score	N
1	After all telecasts seen	59.5	67	54.3	24	58.2	91
2	After not quite all telecasts seen	59.9	214	56.6	26	59.5	240
3	After about half telecasts seen	58.4	39	59.1	173	58.9	212
4	After less than half telecasts seen	52.9	28	53.8	336	53.7	364

One-way Analysis of Variance for above scores (All Viewers):

Source	Sum of squares	Degrees of freedom	Variance estimated	
Between	6,276.6	3	$2092.3 = s^2_b$ $52.1 = s^2_w$	$F = \frac{s^2_b}{s^2_w} = 40.2$
Within	50,123.0	963		
Total	56,399.6	966		$p < .001$

(Continued)

Table 6:18. (Continued)

Selected Contrasts for above scores (All Viewers):

Group	Condition with expected higher score	vs.	Group	Condition with expected lower score	Difference	Level of significance (one-tailed test)
1,2,3	Three more frequent discussion groups combined (Mean = 59.1)		4	Least frequent discussion group (Mean = 53.7)	5.4	$p < .001$
3	About half (Mean = 58.9)		4	(Mean = 53.7)	5.2	$p < .001$
2	Not quite all (Mean = 59.5)		4	(Mean = 53.7)	5.8	$p < .001$
1	All (Mean = 58.2)		4	(Mean = 53.7)	4.5	$p < .001$
1	(Mean = 58.2)		2	(Mean = 59.5)	-1.3	n.s.
2	(Mean = 59.5)		3	(Mean = 58.9)	.6	n.s.
1	(Mean = 58.2)		3	(Mean = 58.9)	- .7	n.s.

performance for all four discussion categories is highly significant ($p < .001$). The selected contrast between the combined mean of 59.1 for the three more frequent participants and the mean of 53.7 for least frequent discussants, a difference of 5.4 points, is significant ($p < .001$), as are all comparisons between the performance of any one of the three more frequent discussion groups and that of the least frequent discussants. None of the differences between the three more frequent discussion groups are statistically significant.

In the research reported in Part I, Volunteer supervision and discussion participation appeared to be related. In the present data, which are shown in Table 6:19, no such relationship can be observed. Probably this is because most of the Volunteers in the areas involved---Bogota and the surrounding Department of Cundinamarca---chose to work among friendly, affable groups, and did not exert great pressure on behavior within the context of viewing. By the time of the "Mathematics for Teachers" course, Bogota and Cundinamarca had had ETV for over a year, and teacher characteristics were relatively well known to Volunteers. In Medellin, where the other research was conducted, ETV at the time was in its first semester, and teacher characteristics were less known. Moreover, as a new site, there was more emphasis in Medellin on innovation. Certainly, these data should not be interpreted to mean that Volunteers cannot exert influence.

Table 6:19. Discussion Participation and Volunteer Supervision of Viewing Groups for High and Low Viewers

High viewers

PCV Supervision:

Discussion participation	No	Yes	
High	72.7 (48)	27.3 (18)	= 100.0 = (66)
Low	68.6 (186)	31.4 (85)	= 100.0 = (271)

$X^2 = .042$

p = n.s.

Low viewers

PCV Supervision:

Discussion participation	No	Yes	
High	76.0 (38)	24.0 (12)	= 100.0 = (50)
Low	80.7 (388)	19.3 (93)	= 100.0 = (481)

$X^2 = .062$

p = n.s.

Summary and Discussion

A math test and a questionnaire on past behavior and opinions in regard to televised instruction were administered to 1,341 teachers in Bogota and Cundinamarca following telecasting of a 17-program modern math course. Some of the teachers had followed the course; some had not. The findings were these:

1) Test performance and viewing of the course were clearly related, suggesting high instructional effectiveness for the course.

2) Between one-third and one-half the teachers viewed almost all or all of the programs, and over one-half viewed one-half or more of the telecasts, suggesting considerable success in reaching the teachers.

3) Viewing was related to Volunteer supervision of viewing sessions, suggesting that the Volunteer can increase the audience for televised instruction.

4) The most wanted instructional aids to accompany televised instruction were a) the opportunity to ask questions of an expert in the subject or (b) to participate in a conference with an expert in the subject, suggesting that the teachers' greatest demand in connection with televised instruction is for feed-back.

5) Among the least wanted instructional aids was post-lesson discussion with other teachers, although discussion can fulfill many of the functions of interacting with an expert and past research had suggested that such discussions could be of great instructional value, suggesting that the promise of teacher discussion depends on further, planned promotion.

6) The teachers varied, depending on the extent of their viewing of the modern math course, in their preferences for instructional aids. The top viewing group equally approved of discussions and the opportunity

to question or confer with an expert. The lower viewing groups expressed interest equal to that of the top group in interchange with an expert, but expressed far less interest in discussions. Thus, the principal objection of those who did not watch was the lack of feedback, for which they did not perceive discussion as a substitute.

7) Teachers who did engage in discussions of course content with other teachers appeared to be more likely to think highly of the usefulness of such discussions, to be more likely to prefer televised over in-person instruction, and to be more likely to think that as much can be learned from televised instruction as from in-person instruction. The relationships could be observed for both high and low viewers, but in regard to the first two only the relationship for the high viewers is absolutely clear-cut.

8) Among viewers, teachers who engaged in discussions relatively frequently performed better on the math test than those who did so less frequently, although there was not a linear progression of improved test performance with every increase in the frequency of discussions.

9) Volunteer supervision of viewing groups was not related to discussion participation, possibly because of selection by Volunteers of congenial groups with which to work.

To anyone interested in televised teacher education in Colombia, these findings are encouraging. The televised modern math course was clearly quite effective, whether the criterion applied is instructional quality or the size of the audience. However, the utility of the findings is not merely congratulatory. Quite the contrary: they delineate both some of the barriers and some of the strategies which might prove profitable for overcoming them.

The chief barrier is simply that a large proportion of teachers doubt that they can learn as much from television as they can from in-person instruction. These teachers are less likely to use ETV than those who think more highly of television's instructional capability. Overall, the instructional aids which might accompany a televised course in which the teachers express the greatest confidence are two which clearly involve feedback: the opportunity to ask questions of or participate in a conference led by an expert in the subject. It seems likely that the principal objection to televised instruction, and the root of the belief that it is not as effective as in-person instruction, is the perceived lack of feedback. Overall, the grass-roots substitute for expert help, teacher discussions, relatively is not highly regarded. However, those who did engage in discussions have a markedly different attitude, both toward it and toward ETV. This was hinted at by the more favorable dispositions of those who viewed all the programs, among which there was a relatively large proportion of discussion participants. When the effects of discussion participation were examined apart from viewing, it was clear that it promoted markedly favorable attitudes, both toward the utility of discussion itself and toward ETV as an instructional medium. Moreover, discussion participation tended to be associated with higher achievement, as measured by test scores.

FOOTNOTES

[1] The course covered such topics as set theory; number systems; principles of geometry; laws of basic operations; fractions, ratios, and proportions; and the like. Each televised lesson was about 30 minutes long. The television teacher was Enrique Amador, who had had 15 years experience in teaching mathematics in primary and secondary schools. The programs were telecast at the rate of two a week, after the last class on two mornings, and both telecasts were repeated, one after the other, on Saturdays at the end of the half day of school.

[2] Other courses which followed include Social Science and Music.

[3] Few teachers have access to a television set outside of school. Many teachers live some distance from the schools in which they teach, and like most urban Colombians, they prefer to travel home for lunch. Almost everyone (including teachers) is allowed two to two-and-a-half hours for lunch, and most of the time is spent in transit to and from home. Watching one of the programs either means giving up part of the lunch period, or remaining at school after the end of the school day.

[4] See Report Nos. 2 and 9 (titles listed at end of this report), this series, for other information gathered from Volunteers in interviews conducted at the end of the first semester of the ETV Project (February-June, 1964).

[5] Of the more than 80 Volunteers involved in the ETV Project, almost 50 were assigned as "utilization" Volunteers to consult with teachers on effective use of television in classroom teaching. In the project, the term "utilization" is used to refer both to what the classroom teacher does in building her teaching around television ("utilizing ETV"), and to the job of the Volunteer working with teachers in the schools to improve such teaching. For more information on the work of the utilization Volunteer, see Report Nos. 2, 3, 4, 5, and 9 (titles listed at end of this report), this series.

[6] Normal schools are secondary schools for teacher training. Students enter them directly from primary school. The course is six years, four of which are devoted to general education and two to teacher training, with the Bachillerato degree granted upon graduation. There is an additional two year sequence, and for completion of the eight years the Normalista Superior degree is granted.

[7] Bi-serial correlations between item responses and total score

were calculated, and items with little or no positive relationship to total score were eliminated. Items which some teachers had difficulty in understanding were either eliminated or re-written.

[8] Other information, such as on the context in which viewing took place was not gathered for several reasons: a) it was possible that the results might contribute only to the perfecting of the test for use in Medellin and Tolima and Huila; b) the teachers, working closely together, were likely to have had other experiences--- such as contact with a Volunteer --- in common; and, c) utilization Volunteers at this time were not giving Ciudad Kennedy concentrated attention.

[9] Teachers were excused from classes to take the test. The two schools were chosen arbitrarily, and all teachers in the second through fifth grades were included to minimize effects of self-selection. The teachers did not know in advance that they would be tested.

[10] Ligia Guerrero, Directora de la Seccion de Television Education, Institute de Radio y Television.

[11] Previously, it was mentioned that Department and local school officials urged teachers to watch the course. In Bogota and Cundinamarca, officials "required" teachers to watch. However, there was no provision for monitoring, supervision, or other enforcement, and no reward --- such as a certificate --- promised for completion. It is impossible to guage the effect of the course being declared a "requirement".

[12] The combining of the viewing groups, and the differing definition of "high discussion participation" for each, was necessary for there to be sufficient persons in the various categories for meaningful statistical analysis.

[13] Because it was expected that discussion participation, by providing a rewarding experience in regard to learning by television, would promote favorable dispositions both toward discussion itself and toward ETV, a one-tailed test is used. In regard to note-taking, research reported in the first part of this report indicated that no such expectation could be entertained, and thus a two-tailed test would be appropriate; however, the results, in regard to note-taking, are the same whether a one-or-two-tailed test is applied.

APPENDIX: The Questionnaire*

Would you please give us the following information on the ETV Project's Teacher Training course in modern mathematics of the past semester:

1. During the past semester, there were 17 teacher training programs on modern mathematics. For some teachers, it was impossible to watch any of these programs. Others could watch almost all the programs. Please indicate below how many teacher training programs you were able to watch.

_____All (17 programs)

_____Almost all (11-16 programs)

_____About half (8-10)

_____Some (1-7)

_____None

2. After watching each teacher training program some teachers took part in organized discussions on the material covered. Other teachers did not participate in these discussions. Please indicate below how often you participated in discussions.

_____Participated after all the programs

_____Participated after almost all the programs

_____Participated after about half the programs

_____Participated after less than half the programs

_____Did not watch the programs

3. Some teachers took detailed notes on the teacher training course in modern math. Others did not. Did you take notes?

_____Yes

_____No

_____Did not watch the programs

4. Some teachers watched the teacher training programs in modern math with a Peace Corps Volunteer, others without his presence. Did you watch with a Volunteer?

_____Never watched with a Volunteer

_____Sometimes

_____Almost always

_____Always

_____Did not watch the programs

* For the original Spanish version, see Report No. 10 this series.

APPENDIX (cont'd.)

5. Which of the following activities, in addition to the televised instruction for teachers, do you think would help you learn more from such a course, as for example the televised course for teachers on modern math? (Mark all that apply.)

_____Discussions with other teachers on course content.

_____A teacher Guide, such as was used with the modern math course.

_____Special printed material in addition to the Guide.

_____Special problems and exercises for additional private practice.

_____Opportunity to ask questions of an expert in the subject.

_____Participation in a meeting or class led by an expert in the subject.

6. Some teachers prefer to watch a television course. Other teachers prefer to participate in a class led by a teacher. What do you think?

_____Prefer television

_____Prefer a teacher leading the class

_____Have no preference

7. Some teachers think one can learn the same from televised courses as from a course led by a teacher. Others don't think one can learn as much. What do you think?

_____One can learn the same through television

_____One cannot learn the same through television

Reports In This Series

This series supplants all previous reports on the two years of research conducted on the Peace Corps Educational Television Project in Colombia. There are 12 volumes -- 10 research reports, each dealing with a different aspect of the project, plus *An Introduction*, concerned with the organization and conduct of the research, and a concluding *Overview*, containing a summary of the major findings and some general observations on the project.

The title of the series: *The Peace Corps Educational Television Project in Colombia -- Two Years of Research*.

The individual volumes:

An Introduction to Research Reports No. 1-10.

Report No. 1: The Project as a Whole -- Organization, Expansion, and Adaptation.

Report No. 2: The Project's First Semester -- Pupil Achievement, Teacher Attitudes, and the Work of the Utilization Volunteer.

Report No. 3: Improving the Effectiveness of the Utilization Volunteer and the Utilization of ETV by the Colombian Teacher.

Report No. 4: The Colombian Teacher and the Utilization Volunteer -- Making ETV Work in the Schools of a Developing Country.

Report No. 5: The Day-to-Day Job of the Utilization Volunteer -- Structure, Problems, and Solutions.

Report No. 6: Instructional Television for the In-Service Training of the Colombian Teacher.

Report No. 7: Improving the Effectiveness of Peace Corps Efforts to Change Teacher Behavior.

Report No. 8: The Televised Curriculum and the Colombian Teacher.

Report No. 9: The Volunteers.

Report No. 10: Feedback to the Peace Corps on Project Progress -- Some Models and Suggestion.

An Overview of Research Reports No. 1-10.

BRIEF FACTS

The ETV Project: In 1963, the Peace Corps, with the financial support of the Agency for International Development (AID), agreed to help the Colombian government establish a nationwide educational television (ETV) system directed primarily at improving public education. The initial Peace Corps goal was to provide televised instruction for primary school pupils and their teachers. It was hoped that eventually the system could also provide instruction for adults in literacy, health, agriculture, and topics of general interest, and for students beyond the primary grades. The ultimate Peace Corps goal is to establish an ETV system operated independently by Colombia. The project was inaugurated in Colombia at the beginning of 1964. It has had two major concerns in achieving its initial goal: the production of televised courses, and the building of a receiving network of schools with television in which teachers would build their own teaching around the instructional "core" provided by the telecasts. During the project's first three years (1964-1966), the number of Volunteers assigned to the project by the Peace Corps who have worked closely with Colombians toward these goals has ranged from 66 to 88. Of these, about half a dozen have been concerned with the installation and maintenance of TV sets in schools, between slightly more than half to two-thirds working with teachers in schools on making ETV more effective, and the rest with the production of telecasts. During the first year, 10 courses were telecast for pupils, each consisting of two 15 minute telecasts a week, for a weekly total of 300 minutes, exclusive of repeated programs; during 1965 and 1966, 15 such courses were telecast, for a weekly total of 450 minutes exclusive of repeated programs. In addition, individual programs and short courses have been telecast for teachers. When telecasting began in February, 1964, the receiving network encompassed approximately 200 schools, 1,000 teachers, and 38,000 pupils; by the end of 1964, 500 schools, 4,025 teachers, and 153,000 pupils; by the end of 1965, 925 schools, 7,000 teachers, and 260,000 pupils; and by the end of this year, 1,250 schools, 8,500 teachers, and 350,000 pupils. Telecasting has been over the open network of the Instituto de Radio y Television, a semi-government agency which telecasts commercially in the evenings, and which also has provided studio facilities for ETV. To achieve its ultimate goal, the Peace Corps has been concerned with building a permanent, financially viable, and competent organization to assume the Volunteers' functions. At present, Peace Corps participation is planned to continue up to the middle of 1968. For more on the ETV Project itself, see Report No. 1: The Project as a Whole -- Organization, Expansion, and Adaptation, this series.

The Research: Because Colombia was the first country in which the Peace Corps undertook an educational television (ETV) project, it decided to provide for close, thorough, and continuing research, and late in 1963 contracted with Stanford University's Institute for Communication Research. The Institute maintained a staff in Colombia actively engaged in research for the first two years of the ETV Project, from January, 1964, through January, 1966. The titles of the final series of reports on its studies appear on the previous page. For more on the research as a whole, see An Introduction to Reports No. 1-10, this series.